General Procedures for Limitations Development

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SECTION 1

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

Pursuant to 401 KAR 5:065, Section 2(4) [40 CFR 122.44], each federally- or delegated state-issued NPDES permit shall include conditions meeting technology-based effluent limitations and standards and water quality standards and state requirements. For new sources or new dischargers, these technology-based limitations and standards are subject to the provisions of 401 KAR 5:065, Section 6 [40 CFR 122.29].

1. TECHNOLOGY-BASED EFFLUENT LIMITATIONS

401 KAR 5:065, Section 2(4) [40 CFR 122.44(a)(1)] requires the imposition of effluent limitations and standards promulgated under Section 301 of the Clean Water Act (CWA), or new source performance standards promulgated under section 306 of the CWA, on a case-by-case determination under Section 402(a)(1) of the CWA, or a combination of the three, in accordance with 401 KAR 5:080, Section 2(3) [40 CFR 125.3]. In accordance with Section 301(b) of the CWA, 401 KAR 5:080, Section 2(3) [40 CFR 125.3] establishes the minimum technology-based treatment requirements which are to be imposed on permits issued under section 402 of the CWA. These standards are divided into two categories: Publicly Owned Treatment Works (POTWs) and dischargers other than POTWs (Industrial).

1.1. Industrial Dischargers

Industrial dischargers are categorized as either an "existing source," "new discharger" or "new source". A "new source" is defined as any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced: (1) after promulgation of applicable New Source Performance Standards (NSPS) in the Effluent Limitation Guideline (ELG) or (2) after proposal of applicable NSPS requirements in an ELG but only if the standards are promulgated within 120 days of proposal. A "new discharger" is defined as any building, structure, facility, or installation: (1) from which there is or may be a discharge of pollutants, (2) that did not commence the discharge of pollutants at that particular site prior to August 13, 1979, (3) is not a new source, and (4) has never received a finally effective NPDES permit for discharges at that site. An "existing source" is defined as any building, structure, facility or installation from which there is or may be a discharge of pollutants which is not a new source or a new discharger.

BPT is the first level of technology-based standards established by the CWA to control pollutants discharged to waters of the US and is generally based on the average of the best existing performance by plants within an industrial category or subcategory.

BCT are technology-based standards for the discharge of existing industrial point sources of conventional pollutants.

BAT are technology-based standards that are the most appropriate means available on a national basis for controlling the direct discharge of toxic and nonconventional pollutants to navigable waters and generally represent the best existing performance of treatment technologies that are economically achievable within an industrial point source category or subcategory. Toxic pollutant means any pollutant listed as toxic under Section 307(a)(1) or, in the case of sludge use or disposal practices, any pollutant identified in regulations implementing Section 405(d) of the CWA. Nonconventional pollutants are not listed as conventional or toxic pollutants.

Unlike BPT, BCT, and BAT, the imposition of which in permits is authorized by 401 KAR 5:080, Section 2(3) [40 CFR 125.3(a)], NSPS requirements are required by Section 306 of the CWA. 401 KAR 5:080, Section 6 [40 CFR 122.29(d)] establishes the compliance date for achieving the pollutant reduction levels specified by the NSPS. 401 KAR 5:080, Section 6 [40 CFR 122.29(d)(1)] states that a new source which meets the applicable promulgated NSPS before commencement of discharge, may not be subject to any more stringent NSPS or to any more stringent technology-based standards under Section 301(b)(2) of the CWA for the soonest ending of the following periods:

(1) Ten years from the date that construction is completed;
(2) Ten years from the date the source begins to discharge process or other non-construction related wastewater; or

(3) The period of depreciation or amortization of the facility for the purposes of Section 167 or 160 or both of the Internal Revenue Code of 1954.

The following table summarizes the requirements for non-POTW or industrial dischargers.

TECHNOLOGY-BASED TREATMENT REQUIREMENTS FOR INDUSTRIAL DISCHARGERS					
Technology-Based Control Level	**Type of Discharger**	**Type of Pollutant**			**Compliance Deadline**
		Conventional	**Nonconventional**	**Toxic**	
Best Practicable Control Technology Currently Available (BPT)	Direct Existing	X	X	X	July 1, 1977
Best Conventional Pollutant Control Technology (BCT)	Direct Existing	X			March 31, 1989
Best Available Technology Economically Achievable (BAT)	Direct Existing		X	X	March 31, 1989
New Source Performance Standards (NSPS)	Direct New	X	X	X	Commencement of discharge
Pretreatment Standards for Existing Sources (PSES)	Indirect Existing-	X	X	X	Date specified in regulation
Pretreatment Standards for New Sources (PSNS)	Indirect New	X	X	X	Commencement of discharge

Pursuant to 401 KAR 5:080, Section 6 [40 CFR 122.29(d)(2)], the protection afforded by the aforementioned deadlines do not apply to more stringent limits of performance based on the following criteria:

(1) The limitations are not technology-based; or
(2) Additional conditions in accordance with 401 KAR 5:080, Section 2(3) [40 CFR 125.3] controlling toxic pollutants or hazardous substances which are not controlled by NSPS, including those controlling pollutants other than those identified as toxic pollutants or hazardous substances when control of these pollutants has been specifically identified as the method to control the toxic pollutants or hazardous substances.

Section 306(c) provides for a state to develop and submit to the EPA Administrator a procedure under state law for applying and enforcing standards of performance for new sources located in the state. If the Administrator finds the state procedure requires the application and enforcement of standards of performance to at least the same extent as by Section 306 then the state is authorized to apply and enforce those performance standards on new sources in the state, except those owned or operated by the United States.

The PSES and PSNS technology-based effluent requirements are applied by POTWs with an approved Pretreatment Program via local limits and user permits.

1.2. Publicly Owned Treatment Works (POTWs)

For POTWs 401 KAR 5:080, Section 2(3) [40 CFR 125.3(a)(1)] requires two categories of technology based effluent standards; Secondary Treatment Standards and Best Practicable Waste Treatment Technology (BPWTT).

1.2.1. Secondary Treatment Standards

Secondary Treatment Standards are defined in 401 KAR 5:080, Section 8 [40 CFR 133]. The following table summarizes these standards.

SECONDARY TREATMENT STANDARDS			
Effluent Characteristic	**30 Day Average**	**7 Day Average**	**Percent Removal**

Biochemical Oxygen Demand (BOD_5)	30 mg/l	45 mg/l	85 %
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	25 mg/l	40 mg/l	85 %
Total Suspended Solids (TSS)	30 mg/l	45 mg/l	85 %
pH	Shall be maintained between 6.0 and 9.0 standard units		

401 KAR 5:080, Section 2(3) [40 CFR 125.3(a)(1)] requires permits for POTWs to include Secondary Treatment Standards from the date of permit issuance.

1.2.2. Special Considerations

401 KAR 5:080, Section 8(4) [40 CFR 133.103] provides for the following special consideration:

Combined Sewers

On a case-by-case basis when a treatment works is unable to meet the percentage removal requirements due to wet weather flows received from combined sewers DOW may establish an alternate percentage removal level.

Industrial Wastes

When a POTW receives wastes from an industrial facility that is subject to an effluent guideline that permits BOD_5 and TSS concentrations less stringent than the secondary treatment standards the values for BOD_5 and TSS may be adjusted provided (a) the permitted discharge of such pollutants, attributable to the industrial category, would not be greater than that which would be permitted under effluent guideline if such industrial category were to discharge directly into the navigable waters, and (b) the flow or loading of such pollutants introduced by the industrial category exceeds 10 percent of the design flow or loading of the publicly owned treatment works.

Waste Stabilization Ponds

The Director may establish alternate TSS concentrations for waste stabilization ponds when (a) the waste stabilization pond is the principal process used for secondary treatment; and (b) operation and maintenance data indicate that secondary treatment levels for TSS cannot be achieved. Such an alternate TSS concentration shall be equal to the effluent concentration achieved 90 percent of the time waste stabilization ponds within the State that are achieving the secondary treatment levels for BOD_5.

Less Concentrated Influent Wastewater for Separate Sewers

For less concentrated influent wastewater for separate sewers a lower percent removal requirement or mass loading limit may be substituted for the secondary treatment percent removal requirements when the permittee satisfactorily demonstrates that (a) The treatment works is consistently meeting, or will consistently meet, its permit effluent concentration limits but its percent removal requirements cannot be met due to less concentrated influent wastewater; (b) to meet the percent removal requirements, the treatment works would have to achieve significantly more stringent limitations than would otherwise be required by the concentration- based standards; and (c) The less concentrated influent wastewater is not the result of excessive I/I. The determination of whether the less concentrated wastewater is the result of excessive I/I will use the definition of excessive I/I plus the additional criterion that inflow is non-excessive if the total flow to the POTW (i.e., wastewater plus inflow plus infiltration) is less than 275 gallons per capita per day.

Less Concentrated Influent Wastewater for Combined Sewers During Dry Weather

For less concentrated influent wastewater for combined sewers during dry weather a lower percent removal requirement or mass loading limit may be substituted for the secondary treatment percent removal requirements when the permittee satisfactorily demonstrates that (a) the treatment works is consistently meeting, or will consistently meet, its permit effluent concentration limits, but the percent removal requirements cannot be met due to less concentrated influent wastewater; (b) to meet the percent removal requirements, the treatment works would have to achieve significantly more stringent effluent

concentrations than would otherwise be required by the concentration-based standards; and (c) the less concentrated influent wastewater does not result from either excessive infiltration or clear water industrial discharges during dry weather periods. The determination of whether the less concentrated wastewater results from excessive infiltration plus the additional criterion that either 40 gallons per capita per day (gpcd) or 1500 gallons per inch diameter per mile of sewer (gpdim) may be used as the threshold value for that portion of the dry weather base flow attributed to infiltration. If the less concentrated influent wastewater is the result of clear water industrial discharges, then the treatment works must control such discharges pursuant to 401 KAR 5:080, Section 6 [40 CFR part 403].

1.2.3. Equivalent to Secondary Treatment

Treatment works may be eligible for the equivalent to secondary treatment standards summarized in the following table:

EQUIVALENT TO SECONDARY TREATMENT STANDARDS			
Effluent Characteristic	**30 Day Average**	**7 Day Average**	**Percent Removal**
Biochemical Oxygen Demand (BOD_5)	45 mg/l	65 mg/l	65 %
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	40 mg/l	60 mg/l	65 %
Total Suspended Solids (TSS)	45 mg/l	65 mg/l	65 %
pH	Shall be maintained between 6.0 and 9.0 standard units		

The following criteria must be met for a treatment system to be eligible for these technology-based standards:

(1) The BOD_5 and TSS effluent concentrations consistently achievable through proper operation and maintenance (40 CFR 133.101(f)) of the treatment works exceed the minimum level of the effluent quality set forth in 133.102(a) and 133.102(b),

(2) A trickling filter or waste stabilization pond is used as the principal process, and

(3) The treatment works provide significant biological treatment of municipal wastewater.

1.2.4. Best Practicable Waste Treatment Technology (BPWTT)

BPWTT has not been defined by EPA but generally means the cost effective technology that can treat wastewater, combined sewer overflows, and non-excessive infiltration and inflow in POTWs to meet Secondary Treatment Standards, Water Quality Standards or more stringent state standards. 401 KAR 5:080, Section 2(3) [40 CFR 125.3(a)(1)] requires permits for POTWs to include BPWTT requirements no later than July 1, 1983. The determination of BPWTT is pollutant-specific.

1.3. Methods of Imposing

Pursuant to 401 KAR 5:075, Section 1 [40 CFR 122.3(c)], technology-based treatment requirements may be imposed through one of three methods:

(1) The application of EPA promulgated effluent limitations developed under Section 304 of the CWA to dischargers by category or subcategory (i.e., ELGs);
(2) On a case-by-case basis under Section 402(a)(1) of the CWA to the extent that EPA-promulgated effluent limitations are inapplicable. The permit writer shall apply the appropriate factors listed in 401 KAR 5:080, Section 2(3) [40 CFR 125.3(d)] and shall consider (a) the appropriate technology for the category or class of point sources of which the applicant is a member, based upon all available information, and (b) any unique factors relating to the applicant using best professional judgment (BPJ), including, where appropriate, limitations expressed in terms of toxicity;
(3) Through a combination of methods (1) and (2) where promulgated ELGs only apply to (a) certain aspects of the discharger's operation, (b) to certain pollutants, or (c) other aspects or activities are subject to regulation on a case-by-case basis in order to carry out the provisions of the CWA.

1.3.1. Effluent Limitation Guidelines

EPA has developed effluent limitation guidelines (ELGs) for 56 specific point source categories. These guidelines typically referred to as ELGs are found in 401 KAR 5:065, Section 2(9)[Title 40, Chapter I Subchapter N (40 CFR Parts 400 thru 471)]. The ELG typically establishes numeric requirements for one or more of the technology-based requirements discussed under Section 1. These numeric requirements may be in the form of: (1) mass based, production normalized, (2) mass based, flow normalized, (3) concentration based, (4) zero discharge of pollutants, or (5) other numeric limitations, e.g. pH, temperature.

Mass Based, Production Normalized Numeric Limitations

To calculate mass based, production normalized numeric limitations, the formula

$$\mathrm{EL} = (\mathrm{LAPR}) \times (\mathrm{ELGF})$$

is used, where the following is true:

EL is the calculated effluent limit expressed as lbs/day.

LAPR is the long-term average daily production rate. The LAPR can be expressed in various units such as 1,000 lbs/day, 102 square feet/day, barrels/day, etc. The LAPR is not the maximum or design production rate for the facility but an average daily, average monthly, or other mean production rate. Typically DOW considers long-term to be equivalent to the term of the permit which is usually 5 years.

ELGF is the effluent limit guideline factor found in the ELG and is expressed in various units such as lbs/1000 lbs, lbs/102 square feet, etc.

Mass Based, Flow Normalized Numeric Limitations

Pursuant to 40 CFR 122.45(f) all pollutants in permits shall have limitations expressed in terms of mass unless such limitations are infeasible.

To calculate these types of limitations for industrial facilities the formula

$$\mathrm{EL} = (\mathrm{LAF}) \times (\mathrm{ELGF}) \times (\mathrm{UCF})$$

is used where the following is true:

EL is the calculated effluent limit expressed as lbs/day.

LAF is the long-term average daily flow and is expressed in terms of million gallons per day (MGD). The LAF is not the maximum or design flow for the facility but an average daily, average monthly, or other mean flow rate. Typically DOW considers long-term to be equivalent to the term of the permit which is usually 5 years.

ELGF is the effluent limit guideline factor found in the ELG and is expressed in mg/l.

UCF is a unit conversion factor equivalent to 8.34 (L-lbs/MG-mg).

To calculate these types of limitations for POTWs the same formula is used with one exception. LAF is replaced with DF

$$\mathrm{EL} = (\mathrm{DF}) \times (\mathrm{ELGF}) \times (\mathrm{UCF})$$

DF is design capacity of the POTW as per 40 CFR 122.45(b)(1) which requires production-based effluent limitations for POTWs to be calculated using the design flow

Concentration Based, Zero Discharge of Pollutants, and Other Numeric Limitations

These types of limitations are directly applied without modification due to production rate or flow of the facility.

1.3.2. Best Professional Judgment

The second method for the imposition of technology-based effluent limitations is through a process known as BPJ. As previously stated in 4.1.2.1 Methods of Imposing, the BPJ process may be used on a case-by-case basis to the extent that EPA-promulgated effluent limitations are inapplicable. The NPDES permit writers handbook and NPDES permit writers training course states that "promulgated effluent limitations are inapplicable" when: (1) EPA has not developed effluent guidelines that apply to the discharge (industry or specific process); or (2) there is an applicable effluent guideline, but pollutants or processes are present that were not considered when the effluent guideline was developed.

401 KAR 5:080, Section 2(3)[40 CFR 125.3 (d)] establishes technical criteria for the permit writer to follow in the development of a case-by-case BPJ determination of appropriate technology-based effluent limitations. These procedures are similar to those utilized by EPA to develop national ELGs. The permit writer determines BPT, BCT, and BAT on a case-by-case basis considering any unique factors related to the facility. The permit writer must develop BPT and BCT criteria for conventional pollutants or BPT and BAT criteria for toxic and nonconventional pollutants.

Technical criteria common to BPT, BCT and BAT include: (1) age of equipment and facilities involved; (2) process or processes employed; (3) engineering aspects of the application of various types of control techniques; (4) process changes; and (5) non-water quality environmental impact including energy requirements. Where the BPJ determination differs for these three levels of technology-based standards is in the area of economic criteria. The following table illustrates these differences.

BPJ ECONOMIC CRITERIA	
Required Technology	**Economic Test**
BPT	Total cost in relation to effluent reduction benefits achieved
BCT	Two part test:
	POTW Cost Test – compares the cost-effectiveness of an upgrade by the facility to meet BCT to the benchmark cost-effectiveness of a similar POTW upgrade (from secondary to advanced treatment)
	Industry Cost-Effectiveness Test – compares the ratio of the incremental cost of going beyond BPT and the incremental cost of going from no treatment to BPT to an industry benchmark
BAT	Economic Achievability – determination of whether the cost of achieving the effluent reduction feasible

It should be noted that 401 KAR 5:080, Section 2(3) [40 CFR 125.3 (d)] does not establish technical criteria or economic criteria for the development of a BPJ equivalent of NSPS. Therefore, based on the requirements of Section 306 of the CWA, 401 KAR 5:065, Section 6 [40 CFR 122.29(d)] and 401 KAR 5:080, Section 2(3) [40 CFR 125.3(d)], DOW has concluded that EPA did not intend for the permit writer to develop a BPJ-equivalent of NSPS.

1.3.3. Combination of ELGs and BPJ Determinations

The third option for imposing technology-based limitations is a combination of the application of an ELG and of a BPJ determination of appropriate technology-based effluent limitations.. Although EPA has developed and promulgated a significant number of ELGs, these guidelines are not comprehensive of all dischargers or pollutants in a wastestream. For example the ELG for Mineral Mining and Processing Point Source Category (40 CFR 436) does not include effluent limitations for Total Suspended Solids (TSS) for several of the subcategories of mineral mining activities address by the ELG. In such cases DOW develops a BPJ effluent limit for TSS to supplement the requirements of the ELG.

1.4. Combined Wastestreams

In many cases a facility may have several wastestreams that are commingled for ease and cost of treatment, known as "co-treatment facilities". There may be a promulgated ELG for one or more of the wastestreams, there may be wastestreams for which an ELG does not exist, and there may be wastestreams that contain pollutants that EPA did not consider in its analysis when the ELG was being developed and promulgated. In

such cases it is necessary for the permit writer to determine an aggregate technology-based effluent on the combined wastestream.

The process for developing an aggregate technology-based effluent is straightforward. The permit writer begins by analyzing each wastestream individually to determine the allowable limits in terms of mass. These allowable limits are then summed to generate an aggregate mass limitation which can be converted to a concentration limitation by using the total flow for the combined wastestreams. The following example illustrates this process.

Example: A discharger commingles three wastestreams in a single treatment unit for ease of treatment. Wastestream one (W_1) is process water subject to an applicable ELG. Wastestream two (W_2) is a non-process wastewater for which no ELG has been developed and promulgated. Wastestream three (W_3) is a pollution-control wastewater that is subject to an applicable ELG; however, the pollutant in question was not addressed by EPA in the development of the ELG.

The permit writer, following the procedures outlined in Sections1.3.1, 1.3.31.3.2, and 1.3.3, has determined the contributions from each wastestream for the pollutant of concern is:

W1 = 105 lbs/day
W2 = 20 lbs/day
W3 = 5 lbs/day

The aggregate limit then is the summation of these three contributing wastestream loads, or 130 lbs/day, to be applied at the point of discharge. It should be noted that wastestream concentrations are never cumulative.

SECTION 2

WATER QUALITY-BASED EFFLUENT LIMITATIONS

2. WATER QUALITY BASED EFFLUENT LIMITATIONS

401 KAR 5:065, Section 2(4) [40 CFR 122.44(d)(1)] requires the imposition of water quality standards and state requirements to consider any requirements in addition to or more stringent than promulgated effluent limitations guidelines or standards under Sections 301, 304, 306, 307, 318 and 405 of the CWA necessary to achieve water quality standards established under Section 303 of the CWA, including state narrative criteria for water quality.

401 KAR 5:065, Section 2(4) [40 CFR 122.44(d)(1)(i)] stipulates that limitations must control all pollutants or pollutant parameters (either conventional, nonconventional, or toxic) which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality.

When determining whether a discharge causes, has the reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a state water quality standard, the permitting authority shall use procedures which account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant or pollutant parameter in the effluent, the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and where appropriate, the dilution of the effluent in the receiving water, pursuant to 401 KAR 5:065, Section 2(4) [40 CFR 122.44(d)(1)(ii)]. For any discharge causing, having the reasonable potential to cause, or contribute to an instream excursion above the allowable ambient concentration of a state numeric criteria within a state water quality standard for an individual pollutant, the permit must contain effluent limits for that pollutant.

When the permitting authority determines that a discharge causes, has the reasonable potential to cause, or contributes to an instream excursion above the numeric criterion for whole effluent toxicity, the permit must contain effluent limits for whole effluent toxicity.

401 KAR 5:065, Section 2(4) [40 CFR 122.44(d)(1)(vi)] requires the permitting authority to establish effluent limits for a specific chemical that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contribute to an excursion above a narrative criterion within the state water quality standard.

2.1. Reasonable Potential Analysis

In late 1999 and early 2000, the Division of Water (DOW) documented its procedures for conducting a reasonable potential analysis. In June 2000, this documentation entitled *Permitting Procedures for Determining Reasonable Potential* (Natural Resources and Environmental Protection Cabinet, Division of Water, May 1, 2000) was submitted to EPA Region IV for review. On July 7, 2000, EPA issued a letter approving the Division of Water's procedures. Both chemical-specific numeric and whole effluent toxicity (WET) procedures were developed.

2.1.1. Chemical-Specific Procedures

When conducting a chemical-specific reasonable potential analysis DOW must first determine the pollutants of concern. Depending on the type of facility being permitted, the wastewaters discharged and the source of the pollutants, this analysis may be performed on a select number of pollutants or may be performed on the entire list of water quality standards found in 401 KAR 10:031. DOW determines the pollutants of concern through the review of the permit application, applicable effluent guidelines, the water quality standards, Discharge Monitoring Reports (DMRs) for existing facilities, etc. For municipal permits this review will include verification of industrial user contribution and, for those with approved pretreatment programs, toxic scans of influent, effluent, and sludge in addition to audits and inspections.

2.1.2. Numeric Procedures

If DOW determines that a promulgated Effluent Limitation Guideline (ELG) applies or has developed limits for a pollutant based upon its Best Professional Judgment (BPJ), then reasonable potential is considered to exist and effluent limitations and monitoring are imposed in the permit. For pollutants where neither an ELG nor BPJ developed limits apply DOW shall develop a Waste Load Allocation (WLA) for the pollutant to determine if reasonable potential exists. DOW utilizes one or more of the computer models in subsequent sections to develop WLAs, taking into account site-specific background receiving water conditions.

The models use actual or predicted background data and discharge data. In running these models, DOW considers five (5) data points as sufficient dataset in most cases. In cases where insufficient data is available, DOW may condition the permit to include a monitoring-only requirement to generate the data; to require additional data collection prior to the development of the permit; or, in cases where the pollutant concentration in the wastewater is not highly variable, a single data point may be used. While most effluents exhibit a lognormal distribution relative to concentrations of constituents being released, DOW has elected not to assume any coefficient of variation for the data set and instead prefers to use the average concentration or loading as indicative of future discharge.

The output of the WLA is compared to the discharge quality to determine reasonable potential using the following criteria: If the average discharge quality is less than 70% of the WLA then monitoring may not be required; if within the range of 70% to 90% then monitoring shall be required; if greater than 90% then a limit shall be required. In the case where insufficient data, i.e. less than 5 data points, exists, or where predicted values were used the permit shall require monitoring for the pollutants at a frequency of once per month for the first year at the end of which a new reasonable potential analysis shall be conducted and the permit may be reopened to modify the conditions.

2.1.3. Narrative Procedures

DOW uses biotic indices, to assess streams to determine the level of support for aquatic life. These indices are used to implement Kentucky's narrative criteria. DOW also uses these indices to determine the reasonable potential for the effluent to adversely affect the aquatic community.

Site-specific data is necessary in order to address reasonable potential to cause or contribute to an excursion from narrative criteria. DOW uses a single baseline data point to determine the level of existing support prior to commencement of the permitted activity. In cases where baseline data is unavailable, DOW may require data collection prior to the development of the permit or condition the permit to include a requirement to generate the data. Additional sample data is required to determine whether reasonable potential to cause an excursion from the narrative standard exists after the permitted activity commences. DOW compares the additional data to baseline biotic indices. Should negative changes in the biotic indices occur, then reasonable potential may exist and DOW may require either an action by the permittee or modification of the permit. Should the negative change in the biotic indices be of sufficient scale as to cause a categorical decline, e.g. moving from the Fair category to the Poor category, then reasonable potential has been demonstrated. A categorical decline is an excursion of the narrative criteria and a violation of the permit unless demonstrated by the permittee that the categorical decline is a result of other causes.

2.1.4. Whole Effluent Toxicity Procedures

Complex wastestreams have a number of variable contributing sources which may be individually toxic or collectively act synergistically to cause toxicity and therefore present a reasonable potential to cause or contribute to instream toxicity. Those industrial and municipal facilities which have been rated as "majors" using EPA's major rating protocols, municipalities with approved pretreatment programs, and industrial dischargers with complex wastestreams are considered to have a reasonable potential by DOW and therefore have whole effluent toxicity (WET) testing included in the permit.

Additionally, 401 KAR 5:065, Section 2(4) [40 CFR 122.44(d)(vi)(C)] allows for the establishment of limits on an indicator parameter for narrative water quality standards. 401 KAR 10:031, Section 4 (1)(f) and (g) include Kentucky's narrative standards for TDS or SC and TSS respectively, which should not be changed to the extent that the indigenous aquatic community is affected. Coupled with site-specific biological surveys, DOW uses WET testing as an indicator parameter for these pollutants.

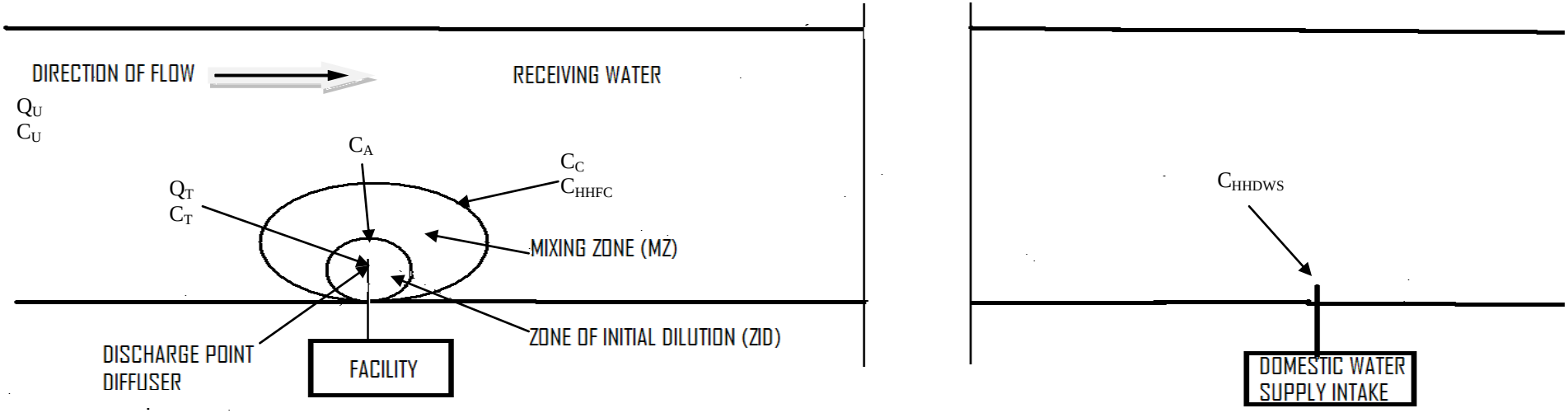
2.2. Derivation of Limitations

2.2.1. Chemical-Specific Criteria

The allowable instream concentrations for specific pollutants are found in 401 KAR 10:031, Section 6(1) Table 1. These water quality criteria are divided into the categories of those for the protection of human health and aquatic life. These categories are further divided into the subcategories of Domestic Water Supply (C_{HHDWS}) and Fish Consumption (C_{HHFC}) for human health and Acute Criteria (C_A) and Chronic Criteria (C_C) for aquatic life. Section 4(2) of 401 KAR 10:029 specify the points within the receiving stream where A_C, C_C, and C_{HHFC} criteria apply. The point where DWS criteria apply is specified by 401 KAR 10:031, Section 3. This section also specifies the stream flows that are used in derivation of water quality based effluent limitations. The following illustration summarizes these requirements.

CHEMICAL-SPECIFIC CRITERIA APPLICATION CONDITIONS			
Criteria	**Sub-Criteria**	**Point of Application**	**Stream Flow**
Aquatic Life	Acute	No Diffuser – End-of-pipe	Not applicable
		Diffuser – Edge of the ZID Receiving Water	7Q10
	Chronic	Edge of Mixing Zone Receiving Water	7Q10
Human Health	Fish Consumption	Edge of Mixing Zone Receiving Water	Harmonic Mean
	Domestic Water Supply	Point of Withdrawal Intake Water	Carcinogen – Harmonic Mean
			Non-Carcinogen – 7Q10

The following figure illustrates the application points for these criteria.



C_A – Acute criteria for aquatic life

C_C – Chronic criteria for aquatic life

C_{HHDWS} - Human Health criteria domestic water supply

C_{HHFC} - Human Health criteria fish consumption

C_T – End-of-pipe effluent limit

C_U – Background pollutant concentration

Q_T – Total Effluent Flow

Q_U – Upstream Flow

Mass-Balance Equation

The chemical-specific water quality limitations are calculated using the following mass-balance equation:

$$(C_U)(Q_U)+(C_T)(Q_T)=(C_D)(Q_U+Q_T)$$

Where:

C_D = pollutant concentration downstream (water quality criteria)
C_T = End-of-pipe effluent limit
C_U = pollutant concentration upstream (stream background condition)
Q_T = wastewater flow
Q_U = receiving stream flow upstream

Solving the equation for C_T first requires rearranging the equation as

$$C_T=\frac{[(C_D)(Q_T+Q_U)-(C_U)(Q_U)]}{Q_T}$$

In the event that the applicable Q_U is zero, $C_T = C_D$.

Mixing Zones and Zones of Initial Dilution

A mixing zone (MZ) is an area where effluent discharge undergoes dilution and is extended to cover the secondary mixing in the ambient waterbody. It is also an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented. 401 KAR 10:029, Section 4 sets forth the requirements for the granting of mixing zones, zones of initial dilution (ZIDs) and the application point of the aquatic life and human health criteria found in Kentucky's Water Quality Standards at 401 KAR 10:031. 401 KAR 10:029, Section 4(1) establishes requirements for the granting of an MZ, and Section 4(2) establishes the points of application for the aquatic life and human health criteria and the requirements and restrictions associated with a ZID.

When granting an MZ, DOW must assign definable geometric limits including the linear distance from the point of discharge, the surface area involved, and the volume of the receiving water, and shall take into account other nearby MZs. For streams and rivers, the assigned MZ shall not exceed 1/3 of the width of the waterbody nor 1/2 of the waterbody's cross-sectional area in any spatial direction. For lakes and reservoirs, the assigned MZ shall not exceed 1/10 of width of the waterbody in any spatial direction. The MZ shall not adversely affect the designated uses of the receiving stream nor adversely affect an established community of aquatic organisms. The location of an MZ shall not interfere with fish spawning or nursery areas, fish migration routes, public water supply intakes, or bath areas; preclude the free passage of fish or aquatic life, or jeopardize the continued existence of endangered or threatened aquatic species or result in the destruction or adverse modification of their critical habitat. Unless assigned by the Cabinet on or before September 8, 2004, there shall be no MZ for bioaccumulative chemicals of concern. Existing MZs assigned by the Cabinet for bioaccumulative chemicals of concern shall expire no later than September 8, 2014. The dilution afforded by an MZ is not allowed unless the applicant requests an MZ and DOW assigns the geometric limits.

A ZID is a regularly-shaped area surrounding the discharge structure that encompasses the regions of high pollutant concentrations under design conditions. ZIDs are restricted to facilities with a submerged high-rate multi-port outfall structure (diffuser). Within the ZID, acutely-toxic concentrations may exist; as such, the acute criteria must be met at the edge of the defined ZID. When determining the size of the ZID, DOW evaluates three cases, the most restrictive of which is used to establish the dimensions of the ZID and the allowable dilutions. The three cases that are evaluated are as follows:

(1) within 10% of the distance from the edge of the outfall to the edge of the assigned mixing zone in any spatial direction;
(2) within 50 times the square root of the cross-sectional area of a discharge port in any spatial direction; and
(3) horizontally within 5 times the natural water depth that prevails under mixing zone design conditions, and exists before the installation of a discharge outlet.

Unless assigned on or before December 8, 1999, a ZID for a pollutant shall not be allowed in an Exceptional Water. Like MZs, the dilution afforded by a ZID is not allowed unless the applicant requests a ZID and DOW assigns the geometric limits.

Mixing Zone

When an MZ is granted, the available upstream flow QU is modified by the MZ factor (MZF). The MZF represents the maximum proportion of the flow allowed to be used for the MZ. The mass-balance equation becomes

$$C_T = \frac{\left[C_D\left(Q_T + \left(MZF\right)\left(Q_U\right)\right) - C_U\left(MZF\right)\left(Q_U\right)\right]}{Q_T}$$

Assuming that the depth is much smaller than width and that the flow is therefore width-dependent, the MZF cannot exceed 0.333 for most streams and rivers. For larger rivers, the cross-sectional limitation of 0.5 is allowed, but 0.333 is generally used to be conservative. Because of the low-flow regime present in lake systems, 0.1 is the maximum MZF for lakes. The MZ dilution (MZD) is then defined as product of the MZF and the ratio of the downstream flow to the upstream flow, or

$$MZD = \frac{MZF\left(Q_T + Q_U\right)}{Q_T}$$

Substituting MZD into the prior equation yields

$$C_T = \left[MZD\left(C_D - C_U\left(\frac{\left(MZF\right)Q_U}{Q_T + \left(MZF\right)Q_U}\right)\right)\right]$$

In the case where the receiving water flow condition is many times greater than the discharge flow, $\frac{\left(MZF\right)Q_U}{\left(Q_T + \left(MZF\right)Q_U\right)}$ approaches 1, which is a conservative assumption since it results in smaller values of C_T. The mass-balance equation can be approximated as

$$C_T = \left(C_D - C_U\right)MZD$$

Zone of Initial Dilution

A ZID is granted when a high rate multi-port submerged diffuser is installed on the effluent pipe. In such cases the ZID dilution (ZIDD) is defined as the ratio of the downstream flow to the upstream flow, or

$$ZIDD = \frac{\left(Q_T + Q_U\right)}{Q_T}$$

And the mass-balance equation is expressed as

$$C_T = \left[ZIDD\left(C_D - C_U\left(\frac{Q_U}{Q_T + Q_U}\right)\right)\right]$$

In cases where the receiving water flow condition is many times greater than the discharge flow, $\frac{Q_U}{(Q_T + Q_U)}$ approaches 1, which is a conservative assumption since it results in smaller values of C_T. The mass-balance equation can be approximated as

$$C_T = (C_D - C_U)\,ZIDD$$

Aquatic Life Criteria

Effluent discharge limitations for a particular constituent for the aquatic live criteria are based on the instream pollutant concentration limits for both acute conditions (CA) and chronic conditions (CC) and an associated ZIDD and/or MZD. The numerical values of the effluent discharge limits for a particular constituent are determined using the following equations. The 7Q10 low-flow condition of the receiving stream is used in place of QU when calculating these criteria.

Acute Aquatic Life Criteria

The acute aquatic life criterion (C_A) is applied at either the edge of the ZID or at the end of the discharge pipe. When a ZID is granted, the mass-balance equation is written as

$$C_T = (LC_1 - C_U)(ZIDD)$$

Where LC1 is the concentration of toxic substance or mixture of toxic substances which is lethal (or immobilizing, if appropriate) to one (1) percent of the organisms tested in a toxicity test during a specified exposure period. The LC50 is the concentration of toxic substance or mixture of toxic substances which is lethal (or immobilizing, if appropriate) to fifty (50) percent of the organisms tested in a toxicity test during a specified exposure period. Due to the difficulty in deriving an LC1, the equivalent value of the LC50, i.e. 1/3 LC50, is used instead. The equation can thus be rewritten as

$$C_T = (0.333LC_{50} - C_U)(ZIDD)$$

The acute criteria listed in Table 1 in 401 KAR 10:031, Section 4 is the LC50 values for those specific pollutants therefore the equation is ultimately written as

$$C_T = (C_A - C_U)(ZIDD)$$

In the case where a ZID has not been granted, the equation becomes:

$$C_T = (C_A - C_U)$$

Chronic Aquatic Life Criteria

As previously stated, the chronic criterion (C_C) is applied at the end of the discharge pipe or at the edge of the assigned regulatory MZ. When an MZ is granted, the mass-balance equation for non-bioaccumulative or non-persistent chemicals is

$$C_T = (0.1LC_{50} - C_U)(MZD)$$

And for bioaccumulative or persistent chemicals is

$$C_T = (0.01LC_{50} - C_U)(MZD)$$

The chronic criteria listed in Table 1 in 401 KAR 10:031, Section 4 is the 0.1LC50 and 0.01LC50 values for those specific pollutants therefore the mass-balance equation is ultimately written as

$$C_T = (C_C - C_U)(MZD)$$

In the case where a MZ has not been granted, the equation becomes

$$C_T = (C_C - C_U)$$

Note: Unless granted prior to September 8, 2004, no new MZs shall be granted for bioaccumulative chemicals and any existing MZ shall expire no later than September 8, 2014. The following table lists those chemicals which are currently defined under 401 KAR 10:029, Section 4(1)(h)2b as bioaccumulative chemicals.

BIOACCUMULATIVE CHEMICALS OF CONCERN		
alpha-Hexachlorocyclohexane	Hexachlorobenzene	Pentachlorobenzene
beta-Hexachlorocyclohexane	Hexachlorobutadiene	Photomirex
Chlordane	Hexachlorocyclohexane	Toxaphene
DDD	Lindane	1,2,3,4-Tetrachlorobenzene
DDE	Mercury	1,2,4,6-Tetrachlorobenzene
DDT	Mirex	2,3,7,8-TCDD (Dioxin)
delta-Hexachlorocyclohexane	Octachlorostyrene	
Dieldrin	PCBs	

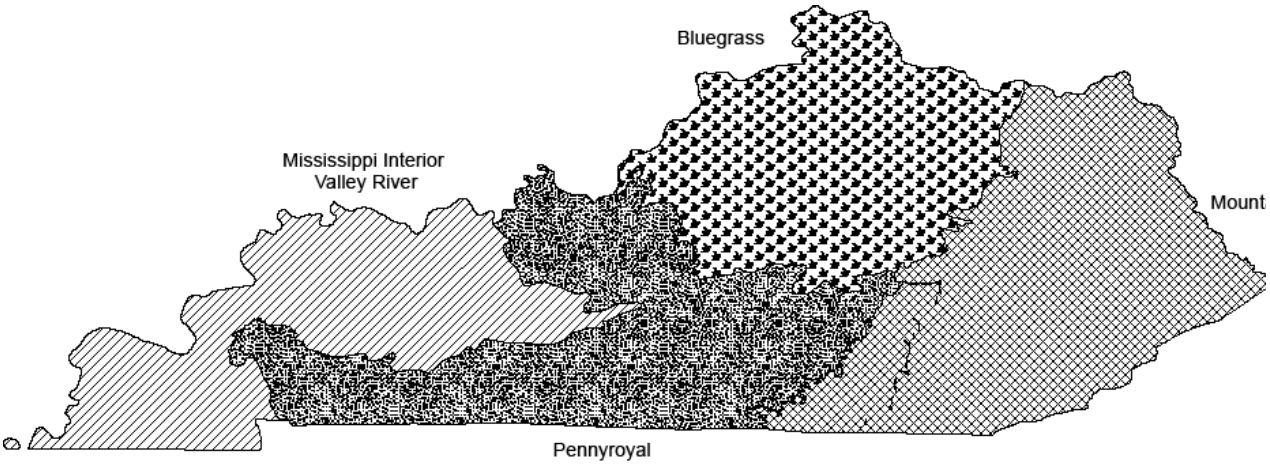
Narrative Criteria

40 CFR 131.11 requires that states must identify water bodies where toxic pollutants may be adversely affecting water quality or the attainment of such designated use, or where the level of such toxic pollutants are at a level to warrant concern and must adopt criteria for such toxic pollutants applicable to the water body sufficient to protect the designated use. In establishing narrative criteria, 40 CFR 131.11(b)(2) specifies that criteria should be based on biomonitoring methods where numerical criteria cannot be established or to supplement numerical criteria. Kentucky has developed criteria to protect aquatic life in 401 KAR 10:031, Section 4, including narrative criteria related to total dissolved solids or specific conductance, total suspended solids, settleable solids, and flow.

Aquatic community integrity may be assessed by monitoring biological indicators, including benthic macroinvertebrates (benthics), fish, and related habitats. KDOW utilizes the Kentucky MBI and KIBI developed by KDOW to assess benthic and fish communities, respectively, in conjunction with the RBP habitat field methods developed by USEPA to evaluate stream conditions for meeting the designated uses of warm and cold water aquatic life, including the narrative criteria, as cited in 401 KAR 10:026, Section 3.

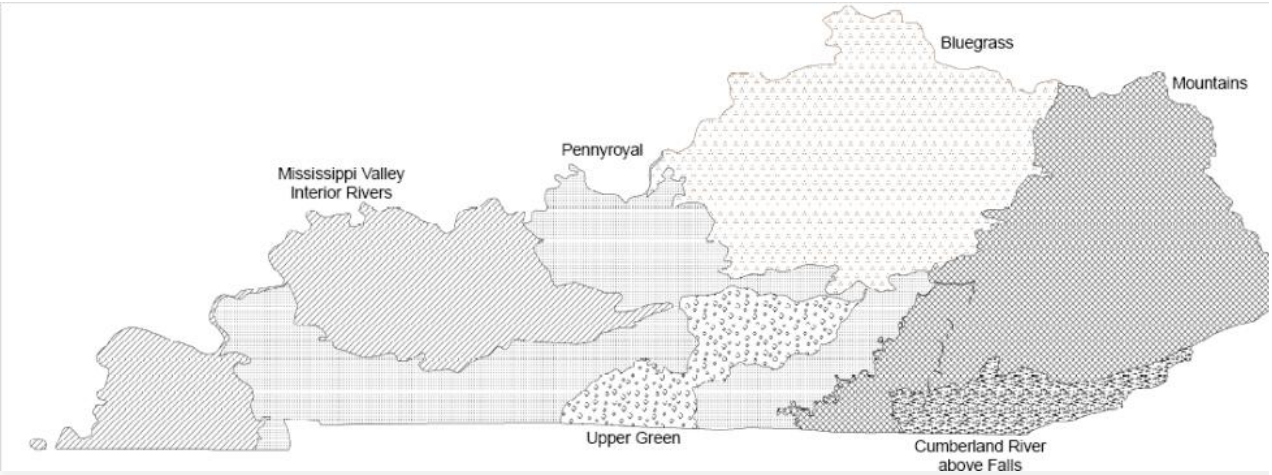
The Kentucky MBI and KIBI include metric scores based on bioregions across the state for benthics and fish, respectively. Numeric metric scores relate to five (5) narrative categories that determine whether the stream meets its designated use for aquatic life. The categories are Excellent, Good, Fair, Poor, and Very Poor. Categories Excellent and Good indicate full support of the designated use; Fair, Poor, and Very Poor indicate non-support of the designated use.

The four (4) bioregions for MBI metrics are the Bluegrass, the Mountains, the Pennyroyal, and the Mississippi Valley and Interior Rivers, as illustrated in the following figure. Associated MBI ranges for each category based on stream size are listed in the following table.



Stream Size	MBI Category	Bluegrass	Mountains	Pennyroyal	Mississippi Valley – Interior River
Headwater (< 5 mi^2 drainage)	Excellent	≥ 58	≥ 83	≥ 72	≥ 63
	Good	51 - 57	72 - 82	65 - 71	56 - 62
	Fair	39 - 50	48 - 71	43 - 64	35 - 55
	Poor	19 - 38	24 - 47	22 - 42	19 - 34
	Very Poor	0 - 18	0 - 23	0 - 21	0 - 18
Wadeable (≥ 5 mi^2 drainage)	Excellent	≥ 79	≥ 82	≥ 81	≥ 58
	Good	61 - 79	75 - 81	72 - 80	48 - 57
	Fair	41 - 60	50 - 74	49 - 71	24 - 47
	Poor	21 - 40	25 - 49	25 - 48	13 - 23
	Very Poor	0 - 20	0 - 24	0 - 24	0 - 12

The six (6) bioregions for the KIBI metrics for fish are Bluegrass, Mountains, Pennyroyal, Mississippi Valley and Interior Rivers, Cumberland River above the Falls, and the Green River Valley, as illustrated in the following figure. Associated KIBI ranges for each category are listed in the following table.



KIBI Category	Bluegrass	Mountains	Pennyroyal	Mississippi Valley – Interior River	Cumberland river above Falls	Upper Green
Excellent	≥ 52	≥ 71	≥ 67	≥ 67	≥ 56	≥ 86
Good	47 - 51	59 - 70	53 - 66	48 - 66	47 - 55	76 - 85
Fair	31 - 46	39 - 58	35 - 52	32 - 47	31 - 46	51 - 75
Poor	16 - 30	19 - 38	17 - 34	16 - 31	16 - 30	26 - 50
Very Poor	0 - 15	0 - 18	0 - 16	0 - 15	0 - 15	0 - 25

Human Health Criteria

For the purposes of protecting human health there are two criteria that must be satisfied, one for fish consumption (C_{HHFC}) and one for domestic water supply (C_{HHDWS}). Either the 7Q10 low-flow condition or harmonic mean stream flow of the receiving water or the source water of the nearest downstream public water supply is used in place of Q_U when calculating effluent limits based on these criteria, as stated below.

Fish Consumption Criteria

Like CC, C_{HHFC} is applied at the edge of the assigned regulatory MZ. However, the harmonic mean flow of the receiving water is used when calculating effluent limits based on these criteria. When an MZ is granted, the mass-balance equation is written as

$$C_T = (C_{HHFC} - C_U)(MZD)$$

In the case where an MZ has not been granted, the equation becomes

$$C_T = (C_{HHFC} - C_U)$$

Domestic Water Supply Criteria

The domestic water supply criteria (C_{HHDWS}) may apply to a pollutant that is categorized as a carcinogen or a non-carcinogen, based on a one-in-a-million or 10^6 cancer risk-protection level. C_{HHDWS} is applied at the point of withdrawal of the nearest downstream public water supply intake using appropriate flow regime of the source water for the public water supply, i.e. the harmonic mean stream flow for carcinogens and the 7Q10 low-flow condition for non-carcinogens. Table B found in 401 KAR 10:026, Section 5(2)(b) lists the surface water intakes for domestic water supply use. Because of this application point, C_{HHDWS} is calculated assuming a complete mix. The mass-balance equation is written for a carcinogen as

$$C_T = \frac{[(C_{HHDWS})(Q_T + Q_{SWHM}) - (C_U)(Q_{SWHM})]}{Q_T}$$

And for a non-carcinogen as

$$C_T = \frac{[(C_{HHDWS})(Q_T + Q_{SW7Q10}) - (C_U)(Q_{SW7Q10})]}{Q_T}$$

Waste Load Allocation Models

DOW uses the models QUAL2E/K, CORMIX and SSTWAM models to assist in the development the WLA. The QUAL2K model develops effluent limitations for biochemically degradable wastewaters from residential types of effluents. CORMIX is a mixing zone analysis model used to determine the size and effect of a mixing zone. SSTWAM is a WLA model that generates effluent limits for toxic pollutants which have water quality criteria. These models are detailed below.

CORMIX

CORMIX is an EPA-supported simulation and decision support system developed by MixZon for environmental impact assessment of mixing zones resulting from continuous point-source discharges. The system emphasizes the role of boundary interaction to predict mixing behavior and plume geometry.

The CORMIX methodology contains systems to model and design single-port, multiport diffuser discharges and surface discharge sources. Effluents considered may be conservative, non-conservative, heated, dense brine discharges or contain suspended sediments. Advanced information systems provide documented water quality modeling, NPDES regulatory decision support, visualization of regulatory mixing zones, and tools for outfall specification.

DOW primarily utilizes this model to determine plume geometry, i.e., allowable MZ and ZID, for multi-port high-rate submerged diffusers with conservative discharges.

River and Stream Water Quality Model

The River and Stream Water Quality Model (QUAL2E/K) is a non-uniform, steady-state mass-balance model that assumes mixing vertically and laterally. The model has the ability to accept many combinations of point or nonpoint sources or withdrawals.

QUAL2K was developed by EPA to modernize QUAL2E, developed by Brown and Barnwell in 1987.

DOW primarily uses the model to develop effluent limitations for biochemically-degradable wastewaters, including BOD, pH, and DO.

Steady-State Toxics Wasteload Allocation Model

The Steady-State Toxics Wasteload Allocation Model (SSTWAM) models is a uniform, steady-state mass-balance model that models water quality using the formulas developed above.

SSTWAM was originally developed by DOW in the 1990s as a steady-state mass-balance workbook in Microsoft Excel.

Whole Effluent Toxicity Criteria

In addition to chemical-specific criteria, 401 KAR 10:031 contains whole effluent toxicity (WET) criteria that necessitate the evaluation of complete effluents. Like the chemical-specific aquatic life criteria, the WET criterion is divided into two categories – acute and chronic. However, WET criteria are not measured in pollutant concentrations but rather in toxicity units (TUs). Toxicity units are defined mathematically as 100 defined by a specific toxic effect. Acute toxicity is expressed in units of TU_A and is defined as $100/LC_{50}$ (in percent). Chronic toxicity is expressed as TU_C and is defined as $100/IC_{25}$. The

IC25 is concentration at which a twenty-five (25) percent reduction is shown in reproduction or growth in test organisms.

Additionally, a relationship between TU_A and TU_C must be defined. This relationship is known as the acute to chronic ratio and is defined as the ratio of acute toxicity, expressed as an LC_{50}, of an effluent to its chronic toxicity. It is used as a factor to estimate chronic toxicity from acute toxicity data. DOW has defined two factors, one for bioaccumulative or persistent and one for non-accumulative or non-persistent effluents. For bioaccumulative or persistent constituents,

$TU_C = 0.01\ TU_A$

For non-bioaccumulative or non-persistent constituents,

$TU_C = 0.1\ TU_A$

Acute Whole Effluent Criteria

Like C_A, C_{AWET} is applied at either the edge of the ZID or at the end of the discharge pipe. Pursuant to 401 KAR 10:029, Section 4(2) and 401 KAR 10:031, Section 4(1)(j), acute toxicity shall not exist within an assigned mixing zone or in the discharge itself unless a ZID has been assigned. Or, more simply stated, C_{AWET} shall not exceed $1.00TU_A$ unless a ZID has been assigned, in which case C_{AWET} shall not exceed $0.3\ TU_A$. The mass-balance equation is written with no ZID as

$$C_T = C_{AWET} = 1.00\,TU_A$$

And with a ZID assigned as

$$C_T = (0.3C_{AWET} - C_U)(ZIDD)$$

Or

$$C_T = (0.3TU_A - C_U)(ZIDD)$$

Chronic Whole Effluent Criteria

Pursuant to 401 KAR 10:031, Section 4(j), the allowable instream concentration of toxic substances or whole effluents containing toxic substances shall not exceed a TUC of 1.00, utilizing the IC25. Like C_C, C_{CWET} is applied at the edge of the assigned regulatory MZ. When an MZ is granted the mass-balance equation is written as

$$C_T = (C_{CWET} - C_U)(MZD)$$

The equation can be rewritten substituting $1.00\ TU_C$ for C_{CWET} as

$$C_T = (1.00\,TU_C - C_U)(MZD)$$

In order to compare C_{CWET} to C_{AWET}, the equation can be rewritten substituting the acute-to-chronic ratio and C_{AWET} for C_{CWET} for a non-bioaccumulative or non-persistent pollutant as

$$C_T = (0.1C_{AWET} - C_U)(MZD)$$

And for a bioaccumulative or persistent pollutant as

$$C_T = (0.01C_{AWET} - C_U)(MZD)$$

In the case where an MZ has not been granted the equation becomes

$$C_T = (C_{CWET} - C_U)$$

If no background data is available for the specific pollutant then C_U is assumed to be zero (0) and C_{CWET} is applied as an end-of-pipe effluent limit.

Exception to Criteria for Individual Dischargers

Kentucky WQS at 401 KAR 10:031, Section 11 enables DOW to grant an exception to criteria through the KPDES permit to an individual discharger based on a demonstration that KPDES permit compliance with existing instream criteria cannot be attained because of one or more of the following conditions:

(1) naturally occurring pollutant concentrations prevent attainment;
(2) natural, ephemeral, intermittent, or low flow conditions or water levels prevent attainment;
(3) non remediable human induced conditions or sources of pollution prevent attainment;
(4) hydrologic modifications preclude the attainment of the use;
(5) non-water quality related natural physical features of the surface water preclude attainment; or
(6) Controls more stringent than those required by Sections 301(b) and 306 of the Clean Water Act, 33 U.S.C. 1311(b) and 1316, would result in substantial and widespread economic and social impact as determined by the guidelines in Interim Economic Guidance for Water Quality Standards Workbook, EPA, March 1995.

SECTION 3

ANTIDEGRADATION

3. ANTIDEGRADATION

The CWA requires each State to develop an Antidegradation Policy and associated implementation procedures for the protection and maintenance of a waterbody's existing water quality. Kentucky's Antidegradation Policy is found in 401 KAR 10:029, Section 1. The antidegradation policy implementation methodology is contained in 401 KAR 10:030.

3.1. Antidegradation Policy

The purpose of 401 KAR 10:026 through 401 KAR 10:031 is to safeguard the surface waters of the commonwealth for their designated uses, to prevent the creation of new pollution of these waters, and to abate existing pollution.

Where the quality of surface waters exceeds that necessary to support propagation of fish, shellfish, wildlife and recreation in and on the water, that quality shall be maintained and protected unless the Cabinet finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the Cabinet's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located.

For point source discharges, water quality shall be maintained and protected in these waters according to the procedures specified in 401 KAR 10:030, Section 1(2)(b) or (3)(b).

In allowing degradation or lower water quality, the Cabinet shall assure water quality adequate to protect existing uses fully.

The Cabinet shall assure that there shall be achieved the highest statutory and regulatory requirements for waste treatment by all new and existing point sources and that nonpoint sources of pollutants be controlled by application of all cost effective and reasonable best management practices.

Water quality shall be maintained and protected in a water categorized as an outstanding national resource water according to the procedures specified in 401 KAR 10:030, Section 1(1)(b).

Water quality shall be maintained and protected in those waters designated as outstanding state resource waters according to the procedures specified in 401 KAR 10:031, Section 8.

If potential water quality impairment associated with a thermal discharge is involved, a successful demonstration conducted under Section 316 of the Clean Water Act, 33 U.S.C. 1326, shall be in compliance with this policy.

3.1.1. Implementation Methodology

All surface waters of the commonwealth have been assigned to an antidegradation category based on specific criteria. These categories are: Outstanding National Resource Water (ONRW), Exceptional Water (EW), Impaired Water (IW) and High Quality Water (HQ).

3.1.2. Outstanding National Resource Water

An ONRW is surface water that at minimum meets the requirements to be designated an Outstanding State Resource Water (OSRW) pursuant to 401 KAR 10:031, Section 8 and demonstrates national ecological or recreational significance. Kentucky has eight (8) such categorized as ONRWs. A list of these waters can be found in 401 KAR 10:030, Section 1(1) Table 1. The implementation methodology for this category of waters is as follows:

(1) The water quality shall be maintained and protected;
(2) New or expanded discharges that result in permanent or long-term changes in water quality are prohibited; and
(3) Temporary or short term changes in water quality may be approved if the changes do not have a demonstrable impact on the ability of the water to support its designated uses.

Exceptional Water

The Cabinet has categorized over 250 surface waters as an EW. To be categorized as an EW, a surface water must meet one or more of the following criteria:

(1) Designated as a Kentucky Wild River and is not categorized as an ONRW;
(2) Designated as an OSRW as established in 401 KAR 10:031, Section 8(1)(a)1, 2, and 3 and Section 8(1)(b);
(3) Contain a fish community that is rated "excellent" by the use of the Index of Biotic Integrity included in Development and Application of the Kentucky Index of Biotic Integrity (KIBI), 2003;
(4) Contain a macroinvertebrate community that is rated "excellent" by the Macroinvertebrate Bioassessment Index included in "The Kentucky Macroinvertebrate Bioassessment Index," 2003; or
(5) Included in the Cabinet's reference reach network.

The implementation methodology for new or expanded discharges to an EW is the same as the implementation methodology for an HQ except when the EW carries a stream use designation of OSRW due to its support of a federally listed threatened or endangered species.

Impaired Water

Surface waters that have been identified pursuant to 33 U.S.C. 1315(b) are categorized as impaired waters. Impaired waters are those waters which have been assessed by the Cabinet as not fully supporting any applicable designated use unless it is designated as an OSRW or the impairment is for fish consumption due to mercury contamination. Surface waters categorized as impaired are listed in DOW's biannual Integrated Report to Congress on the Condition of Water Resources in Kentucky. The implementation methodology for new or expanded discharges to this category of waters is as follows:

(1) All existing uses shall be protected and the level of water quality necessary to protect those existing uses shall be assured in impaired water; and

(2) The process to allow a discharge into an impaired water and to assure protection of the water shall be regulated by the requirements in the Kentucky Pollution Discharge Elimination System Program, 401 KAR 5:050-5:080.

High Quality Water

The largest of all of the antidegradation categories is the High Quality Water (HQ) group. It consists of all surface waters that have not been categorized as an ONRW, EW or IW; it is therefore the default category for any surface water that has not been assessed by the Cabinet. The implementation methodology for new or expanded discharges to HQs consists of the following requirements:

(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected;

(2) An application for a KPDES permit for a new or expanded discharge shall contain information demonstrating that the lowering of water quality is necessary to accommodate important economic or social development in the area in which the water is located, utilizing Form SDAA;

(3) A permit applicant who has failed to demonstrate the necessity and social or economic development importance for lowering water quality shall not receive a permit unless (a) The applicant submits a revised SDAA that demonstrates the necessity for lowering water quality, or (b) The applicant demonstrates that the discharge shall not consume more than ten (10) percent of the available assimilative capacity of the receiving stream outside of a designated mixing zone or zone of initial dilution for each new or increased pollutant in the discharge;

(4) A permit applicant who demonstrates the necessity and social or economic development importance for lowering water quality shall meet the requirements of the KPDES program, 401 KAR 5:050 through 5:080; and

(5) The Cabinet's determination shall be documented in the permit Fact Sheet and included in the administrative record for the permit or action.

Socioeconomic Demonstration and Alternates Analysis

Socioeconomic Demonstration

The socioeconomic demonstration portion of this requirement shall consider the following factors:

(1) The boundaries of the affected community;

(2) The potential effect on employment, including a comparison of local unemployment rates and state and national unemployment rates;

(3) The potential effect on median household income levels, including a comparison of the present median household income level, projected median household income level, and number of households affected in the defined community;

(4)) The potential effect on tax revenues, including current tax revenues in the affected community compared to projected increase in tax revenues generated by the permitted project;

(5) The potential effect of the facility on the environment and public health; and

(6) Other potential economic or social effect to the community that the applicant includes in the application.

Alternatives Analysis

The alternatives analysis shall consider the following factors:

(1) Pollution prevention measures, such as changes in plant processes, source reductions, or substitution with less toxic substances;
(2) The use of best management practices to minimize impacts;
(3) Recycle or reuse of wastewater, waste by-products, or production materials and fluids;
(4) Application of water conservation methods;
(5) Alternative or enhanced treatment technology;
(6) Improved operation and maintenance of existing treatment systems;
(7) Seasonal or controlled discharge options;
(8) Land application or infiltration to capture pollutants and reduce surface runoff, on-site treatment, or alternative discharge locations; and
(9) Discharge to other treatment facilities.

Activities Not Subject to Antidegradation Implementation

The following activities are not subject to the EW or HQ antidegradation implementation procedures:

(1) The renewal of a KPDES permit that does not authorize pollutant loading to the receiving stream in excess of that previously authorized;

(2) An increase in pollutant loading within the limits previously approved by the KPDES permit; or

(3) A new or expanded discharge that the applicant demonstrates shall not consume more than ten (10) percent of the available assimilative capacity of the receiving stream outside of a designated mixing zone or zone of initial dilution for each new or increased pollutant in the discharge.

Activities That Constitute Compliance with Antidegradation Implementation

The following activities constitute compliance with the antidegradation implementation procedures:

(1) The approval of a POTW's regional facility plan pursuant to 401 KAR 5:006 shall constitute compliance with the alternatives analysis and socioeconomic demonstration for a regional facility;

(2) A new or expanded discharge associated with a project identified in the Kentucky Transortation Cabinet's six (6) year road plan; or

(3) An individual MS4 permit issued pursuant to 401 KAR 5:050 through 5:080.

SECTION 4

EFFLUENT LIMITATIONS

4. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Having completed an evaluation of the applicable technology-based effluent requirements and applicable water quality-based effluent requirements, the permit writer determines (1) the pollutants that are to be controlled by chemical-specific numeric effluent limits, (2) WET requirements if appropriate, (3) the type and frequency of self monitoring, and (4) for permit renewals if anti-backsliding applies. .

4.1. Chemical-Specific Numeric Effluent Limitations

The imposition of chemical-specific numeric effluent limitations is necessary when reasonable potential has been demonstrated. Pursuant to 401 KAR 5:065, Section 2(4) [40 CFR 122.44] the permit must contain effluent limitations that satisfy both technology and water quality-based concerns. To comply with this requirement a comparison of the calculated technology-based effluent limitations to the calculated water quality-based effluent limitations is required. When performing such a comparison there must be consistency in the units and the chemical species. Direct comparisons of different speciations of a pollutant are irrelevant and produce illogical results; therefore e.g. calculated technology-based effluent requirements for total chromium must be compared to the calculated water quality-based effluents for total chromium not trivalent chromium.

In general technology-based effluent limitations are expressed in terms of mass, i.e. lbs/day, whereas most water quality-based effluent limitations are expressed in terms of concentration, i.e. mg/l. The permit writer must convert from lbs/day to mg/l or mg/l to lbs/day using the following formulas in order to perform a comparison of the calculated effluent limitations:

$$\text{Load} = \text{Flow} \times \text{Concentration} \times 8.34, \text{ or}$$

$$\text{Concentration} = \frac{\text{Load}}{\text{Flow} \times 8.34}$$

8.34 is a conversion factor with units of l·lbs/MG·mg

Where load is expressed in lbs/day, flow is expressed in MGD, and concentration is expressed in mg/l.

The final effluent limits for a selected pollutant of concern shall be expressed in appropriate units, i.e. mass, concentration or a combination of the two. 401 KAR 5:065, Section 2(4) [40 CFR 122.44 (f)] requires all pollutants limited in permits to be expressed in terms of mass except for pollutants which cannot appropriately be expressed by mass or the applicable requirements are more appropriately expressed in terms of concentrations. Pollutants limited in terms of mass additionally may be limited in terms of other units of measurement, and the permit shall require the permittee to comply with both limitations.

4.2. WET Effluent Limitations

When WET requirements are imposed in the permit a toxicity limit expressed in units of TU_A for acute or TU_C for chronic concerns is included on the effluent page with the chemical-specific requirements. Additional WET language regarding the type of toxicity test required, test protocols and the percent effluent at which the permittee must demonstrate compliance are also included. Percent effluent is determined by taking the reciprocal of the toxicity limit and multiplying by 100. For example if the WET limit is 3.00 TU_C, the permittee must demonstrate that chronic toxicity does not exist in a mixture of 33% effluent and 67% synthetic water.

4.3. Monitoring and Reporting Requirements

All permits are required by 401 KAR 5:070, Section 3 [40 CFR 122.48] and 401 KAR 5:065, Section 2(4) [40 CFR 122.44(i)] to include monitoring and reporting requirements designed to measure compliance with permit conditions.

Monitoring Requirements

The permit must include monitoring requirements for each pollutant limited in the permit and the volume of effluent discharged from each outfall. When establishing monitoring requirements, the permit writer must determine the type, intervals, and frequency of monitoring. The monitoring program is required to be sufficient to yield data that is representative of the monitored activity. In regards to the type of monitoring required, the permit writer must decide if effluent monitoring alone is sufficient or if other monitoring is required. Examples of other types of monitoring and when they are required include:

(1) Influent monitoring when permit conditions are written in the form of a pollutant reduction;

(2) Source water monitoring when permit limits are expressed in the form of net limits;

(3) Internal monitoring when it is infeasible or impractical to monitor at the outfall, i.e. when outfall may be flooded or when it is necessary to demonstrate compliance with a technology-based effluent limit when wastestreams are combined for treatment and discharge; and

(4) Ambient monitoring when permit contains conditions that are measured by changes in receiving water conditions, i.e. hydrographically controlled releases, etc.

In determining the frequency of monitoring, the permit writer considers: size and design of the facility, type of treatment, location of discharge, frequency of discharge (batch, continuous), compliance history, nature of pollutants, number of monthly samples used in developing permit limit, and cost. The frequency of sampling must be of sufficient regularity to provide adequate data to evaluate compliance with the permit limits.

In addition to frequency, the permit writer must specify sample collection requirements. In determining the appropriate sample type, the permit writer considers pollutant characteristics, analytical method requirements, frequency of discharge (batch, continuous), etc. Types of samples most often required are: grab, composite, continuous, and instantaneous.

Grab samples are taken on a one-time basis without consideration of flow rate and time. This sample type is typically used for monitoring batch discharges. Grab samples are required for pollutants that are affected by changes in ambient conditions. Composite samples are made up of two or more discrete aliquots collected over a period of time. They provide a more representative measure of the discharge of pollutants over a given period of time and account for variability in pollutant concentration and discharge rate. Composite samples are defined by the time interval between aliquots and volume of each aliquot and are typically used for pollutants with varying concentration over the period of discharge, i.e. BOD, TSS, chronic toxicity, etc. Continuous and instantaneous samples are used primarily for flow measurements.

Analytical Methods Requirements

Pursuant to 401 KAR 5:065, Section 2(4) [40 CFR 122.44(i)(1)(iv)], pollutant analysis shall be according to test procedures approved under 401 KAR 5:065, Section 2(8) [40 CFR 136] or other methods approved under 401 KAR 5:065, Section 2(9)-(10) [40 CFR subchapters N or O]. 401 KAR 5:065, Section 2(9) [Subchapter N] establishes the ELGs and 401 KAR 5:065, Section 2(10) [Subchapter O] establishes requirements for sewage sludge. When two or more approved analytical methods are available for a pollutant of concern, the method selected must be sufficiently sensitive to demonstrate compliance with the assigned effluent limitation. DOW includes a general statement requiring the permittee to utilize such methods. However, in cases where DOW has determined that a specific analytical method or method detection level (MDL) is required, language is included in the permit requiring that analytical method or MDL, e.g. EPA Method 200.8 for metals, and EPA Method 1631E for mercury.

Reporting Requirements

All permits must contain reporting requirements based upon the impact of the regulated activity. At a minimum, monitoring reports must be submitted annually. In accordance with 401 KAR 5:065, Section 2(4) [40 CFR 122.41(l)(4)], DOW requires analytical results to be reported on Discharge Monitoring

Report (DMRs) form and submitted on a schedule commensurate with the frequency of monitoring, e.g. monthly monitoring equals monthly submission, etc.

4.4. Anti-backsliding Provision

Pursuant to 401 KAR 5:065, Section 2(4) [40 CFR 122.44(l)], when a permit is renewed or reissued, interim effluent limitations, standards or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit.

In the case of effluent limitations established on the basis of ELG, a permit may not be renewed, reissued, or modified on the basis of effluent guidelines promulgated subsequent to the original issuance of such permit, to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit.

Exceptions to the anti-backsliding provision include:

(1) Material and substantial alterations or additions to the permitted facility occurred after permit issuance which justify the application of a less stringent effluent limitation;

(2) Information is available which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of a less stringent effluent limitation at the time of permit issuance;

(3) Technical mistakes or mistaken interpretations of law were made in issuing the permit under Section 402(a)(1)(b) of the CWA;

(4) A less stringent effluent limitation is necessary because of events over which the permittee has no control and for which there is no reasonably available remedy;

(5) The permittee has received a permit modification under section 301(c), 301(g), 301(h), 301(i), 301(k), 301(n), or 316(a); or

(6) The permittee has installed the treatment facilities required to meet the effluent limitations in the previous permit and has properly operated and maintained the facilities but has nevertheless been unable to achieve the previous effluent limitations, in which case the limitations in the reviewed, reissued, or modified permit may reflect the level of pollutant control actually achieved (but shall not be less stringent than required by effluent guidelines in effect at the time of permit renewal, reissuance, or modification).

In no event may a permit be renewed, reissued, or modified to contain an effluent limitation which is less stringent than required by effluent guidelines in effect at the time the permit is renewed, reissued, or modified. In no event may a permit to discharge into waters be renewed, issued, or modified to contain a less stringent effluent limitation if the implementation of such limitation would result in a violation of a water quality standard under Section 303 applicable to such waters

SECTION 5

STANDARD CONDITIONS

5. STANDARD CONDITIONS

All permits issued by DOW include language specific to 401 KAR 5:065, Section 2(1) [40 CFR 122.41], schedules of compliance, and reopener clauses.

Conditions Applicable to All Permits

All permits shall either expressly or by reference include the conditions established by 401 KAR 5:065, Section 2(1) [40 CFR 122.41]. These standard conditions or "boiler plate language" address (1) duty to comply with all conditions of the permit, (2) duty to reapply, (3) need to halt or reduce activity not a defense, (4) duty to mitigate, (5) proper operation and maintenance of treatment facilities and systems, (6) permit actions, (7) property rights, (8) duty to provide information, (9) inspection And Entry, (10) Monitoring And Records, (11) Signatory Requirements, (12) Reporting Requirements, (13) Bypasses, And (14) Upsets.

Schedules of Compliance

All permits contain a general compliance schedule requiring the permittee to be in compliance with all conditions of the permit upon the effective date of the permit. 401 KAR 5:070, Section 2 [40 CFR 122.47] authorizes specific schedules of compliance for the first issuance of a permit to a new source or new discharger when necessary to allow a reasonable opportunity to attain compliance with requirements issued or revised after commencement of construction and for water quality based effluent limitations for water quality standards adopted after July 1, 1977. Such schedules of compliance must include a final date for achieving compliance and interim compliance and reporting dates if the final compliance date is more than one year from the effective date of the permit.

Reopener Clause

In accordance with 401 KAR 5:070, Section 6(1) [40 CFR 122.62(a)(7)], a permit may be reopened for modification or revoked and reissued when required by the reopener conditions of 401 KAR 5:065, Section 2(4) [40 CFR 122.44(b)]. A permit shall be modified, or alternatively revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved in accordance with 401 KAR 5:050 through 5:080, if the effluent standard or limitation so issued or approved:

(1) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit;

(2) Controls any pollutant not limited in the permit; or

(3)This permit may be reopened to implement the findings of a reasonable potential analysis performed by the DOW.